Response to Anonymous Referee #2

The authors present characteristics and climatology of nocturnal Low-Level Jets (NLLJ) over the Taklimakan Desert (TD) with the meteorological reanalysis data. Their investigation, in which they attempt to reveal a linkage between NLLJ and dust emission, is interesting and valuable. The manuscript is well written and structured. I recommend publication after addressing the following concern.

Response: We thank the reviewer for his/her constructive comments and suggestions on this manuscript, which are very helpful for us to improve our paper. Our responses to the specific comments are presented below.

General comments:

- As the authors mentioned in the manuscript, the easterly wind by cold frontal intrusions associated with synoptic scale lows is common and activates large dust storms in the TD. My concern is if the detection scheme can reject such easterly intrusions from the easterly wind activated by NLLJ. Could you tell us the difference between easterly winds caused by the cold front and NLLJ?

Response: The strength of NLLJ wind speed depends on pressure gradient which can be largely related to cold front events. So it is difficult to address the difference between easterly winds caused by the cold front and NLLJ. However we did a composite analysis with all time-matched AOD and wind profile data. As shown in the following figure, significant enhancements of wind speeds in the lower atmosphere are obvious in all seasons. Comparing the following figure with the Figure 10 in the manuscript, we can see that after selecting the data with the appearance of NLLJ, high dust loading dose not significantly correlate with an increase of wind in Spring and Winter. We expect that our method can reject such easterly intrusions from the easterly wind activated by NLLJ in spring season.

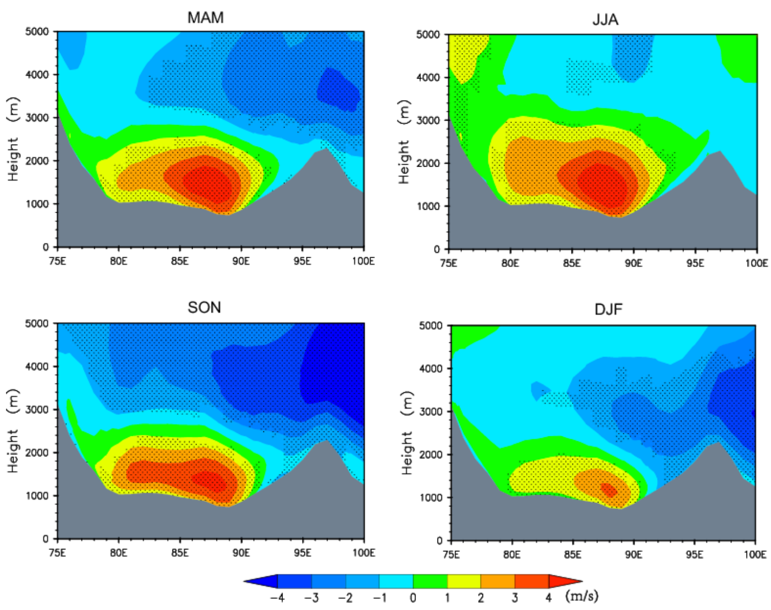

Figure 1. Same as Fig. 10 in the manuscript, but all time-matched AOD and wind profile data are used.

- *I could not find any evidence of direct linkage between NLLJ and dust emission. You used data at 0000 UTC (early morning) for analyses of NLLJ, surface wind and momentum transport. On the other hand, vertical column density (AOT) measured by satellite at 1330 LT (after noon) were used for representation of dust emission. What Figure 10 shows is that appearance of NLLJ has positive relationship with dust column density at afternoon only in Summer and Autumn.*

Response: The effects of NLLJ on dust emission is through the process of downward mixing of momentum. After sunrise, surface heating induces turbulent mixing and mixes momentum from the jet level down to the surface which will cause an enhancement of surface wind speed in the mid-morning and thus lead to dust emission. In our manuscript, the MISR sensor on board the Terra satellite pass the TD region approximately at 10:30 AM. We quantified the convective boundary layer height and the magnitude of the momentum in the boundary layer. Our results show that the NLLJ contains more momentum than without NLLJ, and the downward momentum transfer process is more intense and rapid on days with jet occurrence than no jet days in warm season. Figure 10 indicates that the NLLJ play an important role for dust emission in warm season. Also see the comments from the reviewer #1, and following the suggestion from the reviewer #1, we changed the "emission" by "activity" in the title.

Specific comments:

L49: Could you show reference? Zhang et al. (2003) estimated that the TD is the third most dust source in East Asia. Zhang et al., Sources of Asian dust and role of climate change versus desertification in Asian dust emission, Geophys. Res. Lett., 30, 2272, 2003.

Response: This reference has been added.

L85: in wind speed from 1.0 to 2.0 km?

Response: This statement is from Rife et al.'s paper.

L130: Horizontal resolution of 80 km (1 degree) is enough to detect NLLJ and subsequent mixing of momentum and reinforcement of the surface winds?

Response: The NLLJ over the TD region can extend 1000 km in horizontal and the ERA-Interim data with the horizontal resolution of 80 km should be enough to capture the NLLJ and subsequent mixing of momentum.

L162-L164: Only wind speed has dip in July and August.

Response: There are several reasons that could be responsible for this inconsistent variations of wind and AOD in July and August. For example，MISR has a swath approximately 360 km wide and a path-repeating cycle of 16 days that means MISR does not sample AOD over the TD every day. Another reason may be due to the uncertainties of AOD or wind data. We had compared the monthly mean AODs derived from MISR and CALIOP shown in the following figure. It is interesting to see that the AOD sampled by CALIOP shows a dip in July. Since we only selected night time CALIOP data, diurnal variation of aerosol loading may also be a possible reason.

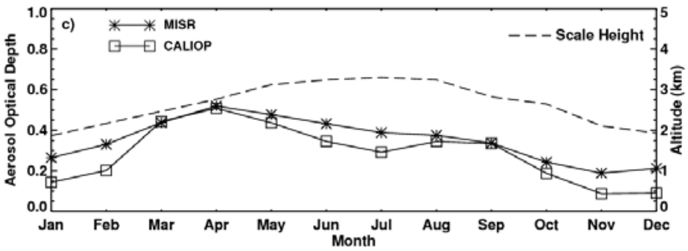

Figure 2. Month mean of AOD as measured by MISR and CALIOP during 2006 through 2012 and aerosol scale height.

L167: In L88, you mentioned the maximum speed of NLLJ occurs around 0000 to 0300 local time. Why did you use wind speeds at 0000 UTC (0600 LT) in Figure 2 instead of 1800 UTC (0000 LT)?
Response: We did examine the jet wind speed at 1800 UTC. We found that the wind speed at 06 UTC was larger than 0000 UTC. We choose 0000 UTC because it is closer to the beginning time of momentum downward mixing after sunrise.

L178-180 and Figure 4: Did you found any seasonal variation in the comparison of the vertical wind profiles between observation and reanalysis data?
Response: We did not compare the seasonal variations of wind profiles between observation and reanalysis. But we calculated the correlation coefficient. It is significant reaching a correlation coefficient of 0.51.

L197: You used reanalysis data at 0000 UTC or 0600 UTC? Please clarify.
Response: The NLLJ detection method was applied to 0000 UTC.

L228-229: How did you conclude Figure 5 is reliable? By comparing with other studies?
Response: Based on the inertial oscillation mechanism, NLLJ usually forms over flat and arid region. After we applied our NLLJ method to the ERA data, we can see that the large frequency occurrence of NLLJ appears highly related to surface types (arid and desert regions) and orography. That makes us feel confident about the NLLJ detection method.

L256: Surface reflectivity in the TD become higher in the cold season (has seasonal variation)? How? Snow cover?
Response: This is because surface albedo varies with the solar elevation angle: In winter the sun is low and the surface albedo is large.

L349: the same but "moment" are significantly different?

Response: The CBL heights for NLLJ and non-NLLJ cases are the same during cold season, but the CBL heights for NLLJ and non-NLLJ cases are significantly different during warm season.

Figure 5 and 8: Cloud you add the TD region in the figure like Figure 1?
Response: The Figures do not look clean after we plotted the white box in Figures 5 & 8. We added the "Taklimakan Desert" in Figure 1.